Soil Characteristic Curves From Tension Infiltrometer and Laboratory Data

S. R. Evett[1], F. H. Peters[2], O. R. Jones[1], and P. W. Unger[1]

[1]*Conservation and Production Research Laboratory, USDA, ARS, Bushland, TX*
[2] *Department of Tropical Land and Water Management, Wageningen Agricultural University Wageningen, The Netherlands*

Long term tillage effects may be effectively characterized on the basis of changes in soil surface hydraulic properties. These properties directly influence infiltration as well as the movement of soil water to the surface during drying. We measured surface soil hydraulic properties on no-till (NT) and conventional (stubble mulch) tillage (CT) plots, each of which was farmed with either a wheat sorghum fallow (WSF) or a continuous wheat (CW) rotation. The plots had been in the same treatments for 12 years. Tension infiltrometers were used to measure steady-state infiltration rates at four tensions (nominally 2.0, 1.5, 1.0, and 0.5 kPa, applied in that order). Both single reservoir and multiple reservoir infiltrometers were constructed. Initial soil water contents were measured by taking volumetric soil samples. Final soil water contents were inferred from the final measured tension at steady state and the soil water retention curve. Hanging water column and pressure plate techniques were used to measure the retention curves on undisturbed core samples. An optimization technique developed by Hussen and Warrick (1993) was used to solve Wooding's equation for $K(h)$ values. The $K(h)$ and $\theta(h)$ data were fitted to Mualem's and van Genuchten's forms for the retention and hydraulic conductivity curves, respectively, using the RETC program. The fitted water retention curves show marked differences between the NT and CT treatments. The more dense NT soils had a less steep drop in the water content as tension increased. The fitted values of θ_s were close to the values of porosity from bulk density data, except in the case of WSF-CT which gave fitted θ_s of 0.52, somewhat below the porosity of 0.56. As the NT soils dry they retain more water, which process may be a factor in the water conservation aspects of no-till plots. The overall fitted $K(h)$ curves showed that K was greater in CT than in NT for both WF and WSF rotations over most of the water content range from 0.1 to 0.5 m^3m^{-3}. These results indicate that greater runoff would be expected for NT compared to CT treatments.

1997. Evett, S. R., Peters, F. H., Jones, O. R., and Unger, P. W. Soil characteristic curves from tension infiltrometer and laboratory data. p. 54. Program and Abstracts of the Characterization and Measurement of the Hydraulic Properties of Unsaturated Porous Media, USDA-ARS, U. S. Salinity Lab., and Univ. of Calif., Dept. of Soil & Environ. Sci., Riverside.